What Determines a Community to Choose the Pathway to Sustainable Development in China?

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Abstract

In this paper, we divide the communities into four groups, namely ecological high-poverty communities, non-ecological high-poverty communities, sustainable communities, and non-ecological low-poverty communities. We have collected the data of 498 counties in 2000 and 2006 to analyze the comparison between sustainable communities and unsustainable communities, and determinants of the development pathways to sustainable communities. The variable means comparison between groups of the ecological high-poverty communities and non-ecological high-poverty communities in 2006 represents that there is no significant difference on the dimensions of economy, society, and environment, excluding the average output value per industrial enterprise. The non-ecological low-poverty communities are more likely to have higher proportion of the secondary industry, higher total industrial output value, higher average output value per industrial enterprise, and higher intensity of infrastructure construction, compared to the sustainable communities. The factors that determine the communities to choose the pathway to sustainable communities are the landscape and social conditions of secondary industry and agriculture, and the economic development level. So the policies that aim at promoting the sustainability of the unsustainable communities will have to focus on the different actions for non-ecological high-poverty and non-ecological low-poverty communities.

Keywords: Sustainable Communities; Sustainable Development; County-level Economy; China

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1. Introduction

The county-level economy plays a vital role in the economic growth of China. There are a total of 2,070 county-level economic entities in China, which cover 95 percent of China's land area, support 74 percent of the population, and generate 60 percent of GDP and 24 percent of fiscal revenues[1].

Most environmental challenges have their roots in local activities (ICLEI, 1993; Thomson & Jackson, 2007). In China, the county governments have the duty and incentive to keep the regional economic growth at a rapid level because of the performance assess from the state governments which emphasizes on the economic achievements. For instance, counties in Central China have an economic development of high speed with the annual average increases in GDP 13.82% from 2000 to 2006, which is much faster than the speed of that of China. Many counties are focusing on promoting industrial development which can stimulate the regional economic growth immediately and significantly. Due to the lack of pollution treatment facilities, the high risk of the public exposed to pollution, the fragile environment in some counties, and the challenges that have been generated by the economic growth have raised grave concerns about the long-term sustainability of these areas. So it is necessary to take integrated measures and actions to deal with the great challenges and complex issues.

Local governments should promote local environmental, economic and social sustainability by translating the principles of sustainable development into strategies that are meaningful to local communities (Thomson & Jackson, 2007). Creating sustainable communities is an important pathway to tackle these environment challenges (Roseland, 2000; Raco, 2005). A sustainable community can be described as a town, county, city or region. A county in China can be considered a community

[1] China Statistical Yearbook (2001-2007).

according to the China's administrative mechanism. The county governments in China are the important agencies charged with community planning and development, which makes them critical players in the movement toward sustainable communities.

The sustainable community development in local regions has already attracted the Chinese government's attention, and some important achievements in sustainable community developments are remarkable (Zhang & Wen, 2008). Finding a pathway to sustainable communities during the coming decades is of critical importance and will largely depend on successful development and implementation of efficient policies towards sustainable development in the counties of China.

There remains, however, little critical evaluation of the difference between sustainable communities and unsustainable communities, together with the incentive to choose the pathways to unsustainable communities by quantitative methods. The purpose of this research has been to determine whether the sustainable development impacts the economic growth in a community, and what determines a community to choose the pathway to sustainable development or unsustainable development.

The rest of the paper is organized as follows. Section 2 reviews literature about the factors that influence the development process of sustainable communities and the determination of a community to choose the pathway. The methodology is presented in section 3. Section 4 describes the comparison between sustainable communities and unsustainable communities. Section 5 discusses the determinants of the development pathways to sustainable communities. Finally, conclusions are provided in Section 5.

2. Literature Review

A sustainable community is continually adjusting to meet the social and economic needs of its residents while preserving the environment's ability to support it (Roseland, 2000). A sustainable community seeks a better quality of life for all its residents while maintaining nature's ability to function over time by minimizing waste, preventing pollution, promoting efficiency and developing local resources to revitalize the local economy (Minnesota SEDEPTF, 1995; Hamstead & Quinn, 2005). The literature on sustainable communities addresses both the characteristics of a sustainable community (Beatley, 1995; Beatley & Manning, 1997; Roseland, 2000; Wint, 2002) and the process by which a sustainable community is developed (Beatley, 1995; Rees, 1995; Campbell, 1996; Kear, 2007). The factors that influence the development process of sustainable communities have also begun to receive attention in the present studies. A common theme among 3 disparate case studies that are in Western Canada, Botswana and Guernsey, UK respectively, is the need to develop a mechanism that brings together experts and community members to develop indicators that measure progress towards sustainability (Fraser, Dougill, Mabee, Reed & McAlpine, 2006). Given the general reluctance of governments at all levels to consider non-economic and, particularly, non-market policy instruments, it is pragmatic as well as timely to improve the understanding of economic instruments for a sustainable community development (Roseland, 1996; Smith, Blake, Grove-White, Kashefi, Madden & Percy, 1999; Hamstead & Quinn, 2005). Roberts (2006) reviewed some of the fundamental requirements for the evaluation of sustainable community development and provided research evidence that indicates the need for procedural and institutional innovation. The evidence in support of innovation reflects the need for assessment procedures and methods to be tailored-to-fit the environmental, social and economic conditions obtaining to an individual region. Conroy and Berke (2004) used plan content analysis as well as survey data for 42 communities across the United States to analyze factors which influence the promotion of sustainable development. Their findings highlight that the presence of a state planning mandate, most applicable to US planning, and having a variety of groups participating in the planning process, are key factors that increase overall plan support for the sustainable development principles. Indicators that are used to measure the community sustainability are advocated to have significant impact on sustainable community development that includes yielding many intangible benefits, building connections between people, and fostering discussion in the community (Gahin, Veleva & Hart, 2003). According to the analysis of 52 submissions to the first annual sustainable community competition from municipalities across Canada, Parkinson and Roseland (2002) proved that urban municipalities are more likely than rural municipalities to undertake sustainability projects, and stakeholder involvement is found to be the most important factor in determining the success of a project.

Additional attention has also been drawn to analyzing the sustainable communities in China. A system dynamics model has been developed to explore the potential long-term ecological, economic, institutional and social interactions of ecological agricultural development through a case study of Jinshan County in China (Shi & Gill, 2005). The results of this case study indicate that the diversification of land-use patterns, government low interest loans and government support for training are important policy measures for promoting the sustainable development of the ecology. A short list of 17 sustainability indicators which contribute to assess the process development of a sustainable community is proposed to be used as a measurement tool in Chongming County, Shanghai (Yuan, James, Hodgson, Hutchinson & Shi, 2003). Systems thinking about the development of sustainable communities is applied in the analysis of the Ping-Ding community (Taiwan, China) by means of the Sensitivity Model (SM) (Chan & Huang, 2004), which is proved to be a convenient and effective tool for the process of public participation and consensus, which is a key element of the implementation of sustainable development. In the case study on Ningjin County, China, sensitivity analysis shows that farming practices, which are economically viable, should not be promoted at the cost of the environment (Zhen, Routray, Zoebisch, Chen, Xie & Cheng, 2005).In studies on the villages in China by the team of SUCCESS (Sustainable Users Concept of China Engaging Scientific Scenario), the villages would be incrementally enlarged and more diverse and complex through a variety of scenarios until it emerges as a modern, sustainable town or city (Levine, Hughes, Mather & Yanarella, 2008), and develops a pathway to sustainable mobility in rural China (Dalkmann, Hutfilter, Vogelpohl & Schnabel, 2008).

The pathway to a sustainable community can be defined as a portfolio of activities and choices that one community makes to achieve its sustainable development goals (Roseland, 2000; Allbee, 2005; Jansen, Pender, Damon, Wielemaker & Schipper, 2006). A number of previous studies have attempted to implement the pathways to sustainable communities. Industrial ecology is a promising pathway that planners can use to create more sustainable communities, which is proved by a case study of a successful eco-industrial system in Kalundborg, Denmark (Dunn & Steinemann, 1998). Pengder (2004) reviewed hypotheses and evidence about the development pathways (common patterns of change in livelihood strategies) occurring in hillside and highland areas and their implications for sustainable land management and poverty reduction, based upon community level survey results from Honduras, Uganda and Ethiopia. His findings were that different development pathways are suited to areas of different comparative advantages; that these differences in comparative advantages are substantially affected by differences in agricultural potential, access to markets and infrastructure, population density, and the presence of programs and organizations. Because of the high reliance of rural hillside households on agricultural and related income in Honduras, any strategy targeted at developing sustainable communities of these areas will have to be built upon the economic base created by agriculture, though the agriculture alone cannot solve the rural poverty problem (Jansen, Pender, Damon, Wielemaker & Schipper, 2006). The planning of community health schemes by non-governmental or faith-based organizations is considered as valid and necessary for sustainable communities in rural areas of developing countries (Smith, Harper, Potts & Thyle, 2009). It is evident that a proposal to develop sustainable communities in Edinburgh's South East Wedge is transforming the new settlement phenomenon in search for plan led, environmentally friendly and sustainable patterns of settlement (Deakin, 2002).

Most of the present studies on sustainable communities have focused on the characteristics, the development process, or a concrete aspect of a sustainable community based on the case studies. With the implementation of sustainable community plans in the world, some questions are considered to be necessary to be addressed and argued, such as (1) what is the difference between the sustainable community and unsustainable community in the three dimensions that consist of society, economy and ecology? (2) Can the implementation of sustainable development plans impact the economic growth if a community chooses the pathway to sustainable development? (3) What determines a community to choose the pathway to sustainable development? In the following discussion, we present the argument to the solutions of these questions.

3. Methods and data

The communities of the developing regions face distinctly different challenges than those confront the communities of developed regions (Roseland, 2000). From the perspective of sustainable development, the basic problem with developed regions is that they meet their needs at rates the environment cannot afford, whereas the basic problem with developing regions is that they are underdeveloped. The major source of environmental degradation is largely resulted from wealth, instead of poverty (Feitelson, 1998). The different pathways to the pursuit of wealth can lead a community to be sustainable or unsustainable. The pathway communities develop will largely determine the success or failure in overcoming the environmental challenges and achieving sustainable development. Developed regions provide enormous, untapped opportunities to deal with environmental challenges; and the developing or poverty regions can focus on some special aspects that contribute to sustainable development (Levine, Hughes, Mather & Yanarella, 2008; Dalkmann, Hutfilter, Vogelpohl & Schnabel, 2008).

One of the most popular methods divides China into four economic areas, namely Eastern China, Central China, Western China and Northeast China. Of these four areas, Central China which consists of Anhui, Henan, Hubei, Hunan, Jiangxi and Shanxi Province (see Figure 1), covers 10.7 percent of China's land area, and accounts for 26.8 percent to China's population in 2006 [2]. Given the increasing attention by the Central Government on Central China in recent years, the average annual GDP growth rate of 498 counties in Central China reached 13.82 between 2000 and 2006, but the extensive growth mode depleted large amounts of resources and brought high pollutant emissions (Zhang & Wen, 2008).

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[2] China Statistical Yearbook 2007.

<Figure 1 about here>

Our research focuses on the 498 counties in Central China for the similar economic policy in Central China, and similar material foundations of economy and society.

Sustainability has economic, social and ecological dimensions to it. In this paper, we group the communities by the economic and ecological dimensions since the social development levels of the countries are not been measured in a universal way yet. So, four groups are indentified, namely ecological high-poverty communities, non-ecological high-poverty communities, ecological low-poverty communities, and non-ecological low-poverty communities. According to the definition of the sustainable community, the ecological low-poverty communities can be considered as sustainable communities. The other three groups should be classified to unsustainable communities.

According to the standard Outline for the Poverty-relief Development in Chinese Rural Areas (2001-2010) [3] issued in June, 2001, 592 counties in 27 provinces, autonomous regions, and municipalities directly under the Central Government were listed as the key poverty-stricken counties to be aided in this poverty alleviation program, covering over 72 percent of the rural poor across the country. We consider the key poverty-stricken counties as poverty communities in this paper, and the rest of the counties as non-poverty communities. In Central China, 150 counties belong to the key poverty-stricken counties.

In 1995, the Chinese government released an initiative for sustainable community development which is called Planning Outlines for National Ecological Demonstration Area (1996-2050). It specifies that an ecological demonstration area is an administrative region that has succeeded in overcoming the conflict between environmental protection, social development and economic growth. So in this paper, we consider a national ecological demonstration area with low-poverty as a sustainable community. Further more, we also think that the development of a

[3]The Central People's Government of the People's Republic of China. *Outline for the Poverty-relief Development in Chinese Rural Areas (2001-2010).* http://www.gov.cn/gongbao/content/2001/content_60922.htm.

national ecological demonstration area with high-poverty is more sustainable than the development of a non-ecological area with high-poverty. Ministry of Environmental Protection of China has issued 528 ecological demonstration counties or cities. In Central China, 140 counties have been identified as ecological demonstration areas between 2001 and 2006. Ninety-one of them with low-poverty can be considered as sustainable communities.

We divide 498 counties into 4 groups, as Table 1 shown.

<Table 1 about here>

The different development pathways will result in the distinctions in the dimensions of society, economy and environment. For instance, sustainable communities are restricted by the environment criteria of investment projects before they get started, which reduces the number of industrial investment projects, and restrains industry development in sustainable communities. For the purpose of this study, we use 3 dimensions to examine the difference between the four categories of communities by the method of the variable means comparison. Considering the availability of data collection of the 498 counties, we select the statistical indicators related to the 3 dimensions as the variables we use in this paper from the yearbooks of the 6 provinces in Central China. The variables cover most of familiar indicator in present studies (Jansen, Pender, Damon, Wielemaker & Schipper, 2006; Fraser, Dougill, Mabee, Reed & McAlpine, 2006; Zhang & Wen, 2008).

Economic dimension. This dimension includes the variables of GDP (Gross Domestic Product), per capita GDP, the growth rate of per capita GDP, the proportion of secondary industry, total industrial output value[4], the growth rate of total industrial output value[5], the average output value per industrial enterprise, agricultural productivity per farmer, the intensity of infrastructure construction, fiscal revenue of local government, and fiscal expenditure of local government. These variables can explain the reason why a community chose the pathway to sustainable development.

[4] Non-state-owned industrial enterprises above designated size are those with annual revenue from principal business over 5 million Chinese Yuan. The same applies to the tables following.

[5] Non-state-owned industrial enterprises above designated size are those with annual revenue from principal business over 5 million yuan. The same applies to the tables following.

If a community attaches more importance to the industrial development, it is enduring more pressures of environment degradation which makes them unsustainable communities. The communities with higher per capita GDP have no strong incentive to prefer the economic development, and they always choose the pathway to sustainable development.

Societal dimension. We measure this dimension using the variables of urbanization rate, the proportion of employed persons of total population, the growth rate of employed persons, per capita urban & rural savings deposits, the growth rate of per capita urban & rural savings deposits, the average number of telephones for every 100 people, the average number of hospital beds for every 10,000 people, and the average number of welfare home beds for every 10,000 people. These variables have the influences on the societal dimension. The impact of the urbanization rate depends in part on how people are housed, how the cities are designed and whether people find job satisfaction when they arrive in the city. People have higher per capita urban & rural savings deposits represent that they would pursue a life of higher quality and have more incentive to protect against environment degradation.

Environmental dimension. This dimension is measured by the variables of the area of cultivated land for every 10,000 people, the alterative rate of area of cultivated land for every 10,000 people, the average number of gas pollutant factories for 100 KM^2, and the average number of water pollutant factories for 100 KM^2.

We collected the data of the variables mentioned above from the 2007 yearbooks of the 6 provinces in Central China.

We assume that all the 498 counties did not have strong incentive and consciousness to develop sustainable communities before the Planning Outlines for National Ecological Demonstration Area (1996-2050) was issued. With the promotion and instruction of environment regulations, some counties chose the pathway to a sustainable community or a ecological community according to their own development features of society, economy and environment. The factors that influence the counties to develop sustainably are various, such as landscape, population, economic development level, and social development level. We use a Multi-logit method to examine the factors that influence a county to choose the pathway to a sustainable community. In 2002, Ministry of Environmental Protection of China issued the first list of ecological demonstration zones. So, we can assume there was no significant difference among the development pathways in 2000. We collected the data of 498 counties in 2000 for analysis. The variables include landscape, population, population intensity, GDP, per capita GDP, value-added of the secondary industry, the proportion of secondary industry, total industrial output value, the average output value per industrial enterprise, agricultural productivity per farmer, the intensity of infrastructure construction, fiscal revenue of local government, fiscal expenditure of local government, urbanization rate, the proportion of employed persons of total population, per capita urban & rural savings deposits, the average number of telephones for every 100 people, the average number of hospital beds for every 10,000 people, and the average number of welfare home beds for every 10,000 people.

4. The comparison of the influences of the sustainable development of the communities

The purpose of this analysis has been to determine the influences that the pathway to sustainable development have on the economy, society, and environment. We compare the ecological communities and non-ecological communities at different economic development level, namely high-poverty communities and low-poverty communities. A comparative summary of these variables is shown in Table 2.

<Table 2 about here>

<Table 3 about here>

From Table 2, it looks as if there are significant differences in some variables. But this conclusion can only be drawn by Independent-Sample T test method. We use this method to examine the difference of the variables means of poverty groups and non-poverty groups respectively by SPSS 13. The results are shown in Appendix 1 and Appendix 2. Table 3 shows the comparison results that are significant at a $p<0.05$ level.

The results indicate that comparison of means of ecological high-poverty communities and non-ecological high-poverty communities for the variable of the average output value per industrial enterprise is significant at a $p<0.05$ level. In the result of the Levene's test, $F= 6.776904$, and $p=0.010175<0.05$, which means that the hypothesis that the variance of the average output value per industrial enterprise should be equal is rejected, so we use the "equal variances not assumed". The result shows that 2.09084, and $0.040225<0.05$, which means that the hypothesis is accepted at a $p<0.05$ level.

The results show that comparison of means of ecological low-poverty communities and non-ecological low-poverty communities for the variables of the proportion of the secondary industry, the total industrial output value, the average output value per industrial enterprise, and the intensity of infrastructure construction is all significant at a $p<0.05$ level. The accepted hypothesizes are "equal variances not assumed". The results of the Levene's test in these variables are shown in table 3. For the variable of agricultural productivity per farmer in the groups of sustainable communities and non-ecological low-poverty communities, the hypothesis "equal variances assumed" is significantly accepted at a $p<0.05$ level.

Comparison of means of each compared groups for the rest of the variables are not significant at a $p<0.05$ level, as Appendix 1 and Appendix 2 shown.

5. Determinants of the development pathways to sustainable communities

Achieving a healthy, sustainable community requires a long-term, integrated, and systems approach to addressing economic, environmental, and social issues. In this paper, we use the data in 2000 to estimate the factors that influence a community to choose a more sustainable development pathway in China.

We use a Multi-logit model to explain the development pathways choice (Greene, 1990). The regression results are presented in Table 4 and Table 5. As Table 4 shows, Chi-square is 346.461, and DF is 57, and $p=0.000$. It means at least one explanatory variable is statistically significant in the final model.

<Table 4 about here>

<Table 5 about here>

As Table 5 shows, the coefficients represent the effect of each explanatory variable on the ratio of the probability of the development pathways choice, relative to the probability of non-ecological low-poverty communities.

The results show that the communities that chose the pathway to ecological high-poverty communities are more likely to have more mountainous landscape, higher per capita GDP, higher fiscal expenditure of local government, lower population intensity, lower proportion of secondary industry, lower agricultural productivity per farmer, lower fiscal revenue of local government, and lower average number of telephones for every 100 people. These communities that have more mountainous landscape, lower population intensity represent, and lower average numbers of telephones for every 100 people were not fit to develop industry economy because of the absence of labor, worse traffic, and communication conditions, so the mean of proportion of secondary industry is significantly lower than the mean of the group of non-ecological low-poverty communities. Because of the higher per capita GDP, these communities were able to achieve the sustainable development with higher fiscal expenditure of local government. These communities have been poverty regions because the agricultural productivity per farmer was lower and the natural or social fundaments in these communities were unfit to develop industry economy. Hence, these communities chose the pathway to ecological high-poverty communities.

Non-ecological high-poverty communities are more likely to have more mountainous landscape, higher intensity of infrastructure construction, higher fiscal expenditure of local government, lower proportion of secondary industry, agricultural productivity per farmer, fiscal revenue of local government, and average number of telephones for every 100 people in 2000. Similar to the ecological high-poverty communities, these communities have been poverty regions because the agricultural productivity per farmer was lower and the natural or social fundaments in these communities were unfit to develop industry economy. What is different is that these communities did not have per capita GDP, or population intensity, so they did not have enough resources to achieve sustainable development, and had to invest in constructing the infrastructure. Hence, these communities chose the pathway to non-ecological high-poverty communities.

Sustainable communities have higher fiscal expenditure of local government, higher per capita urban & rural savings deposits, and lower fiscal revenue of local government. The higher per capita urban & rural savings deposits represent that people in these communities would pursue a higher quality of life and have more incentive to protect against environment degradation. Though the fiscal revenue of local government is a little lower, but fiscal expenditure of local government is higher which means that they could spend more of the government fiscal budget on environment protection. Hence, these communities chose the pathway to sustainable communities.

6. Conclusions

According to the variable means comparison between groups of the ecological high-poverty communities and non-ecological high-poverty communities in 2006, there is no significant difference on the dimensions of economy, society, and environment, excluding the average output value per industrial enterprise. The higher mean of average output value per industrial enterprise of ecological high-poverty communities represents that larger enterprises can reduce the impact on the environment relative to smaller enterprises.

The non-ecological low-poverty communities are more likely to have higher proportion of the secondary industry, higher total industrial output value, higher average output value per industrial enterprise, and higher intensity of infrastructure construction, compared to the sustainable communities. Because of attaching more importance to the industrial development, these communities are enduring more pressures of environment degradation which makes them unsustainable communities. While the comparison of means of the two groups for variables of per capita GDP, the proportion of employed persons of total population, per capita urban & rural savings deposits, and the average number of hospital beds for every 10,000 people, etc, are not significant, the industrial development has not benefited the people in these communities. So an evident conclusion can be drawn from the comparison results of the four groups is that the implementation of sustainable development plans does not impact the economic growth if a community chooses the pathway to sustainable development. In other words, people can benefit from the sustainable development.

The factors that determine the communities to choose the pathway to sustainable communities are the landscape and social conditions of secondary industry and agriculture, and the economic development level. If the communities are not fit to develop secondary industry and agriculture because of the mountainous landscape, they become poor areas because of the lower secondary industry and agricultural potential. But if the per capita GDP is higher which means the communities have no strong incentive to prefer the economic development, they choose the pathway to sustainable development. In terms of the low-poverty communities, if people have higher per capita urban & rural savings deposits which represent that they would pursue a life of higher quality and have more incentive to protect against environment degradation, the communities choose the pathway to sustainable development.

Of 498 counties in Central China, only 91 counties belong to sustainable communities. With a consistent rapid economic growth, it will be necessary to modify the development pathways of the unsustainable communities. The policies that intend to promote the sustainability of the unsustainable communities will have to focus on the different actions for non-ecological high-poverty and non-ecological low-poverty communities. The policies for non-ecological high-poverty communities should be emphasized on how to reduce livelihood pressure. The government can provide the financial support to build upon the economic base created by agriculture, invest in the infrastructure construction, and move the residents from communities with high population intensity to other communities. For non-ecological low-poverty communities, for they have a strong incentive to develop the industrial economy, the policies should be emphasized on reducing the impacts on the environment, including promoting industrial enterprises to adopt new technology and approaches to reduce the use of energy and pollution, strictly constraining the development of industrial projects that will take up large land and produce serious pollutants, keeping the current cultivated land fixed, encouraging the community' involvement, and increasing the public awareness of sustainable development and an understanding of what the community wants.

Because of the regional differences in environmental carrying capacity and development capabilities, the government should strengthen land planning, improve policies for regional development and adjust the geographical distribution of economic operations in accordance with the requirement to form development priority zones, such as optimizing development zone, stimulating development zone, restrictive development zone, prohibitive development zone. It is also very important to change the emphasis of the government performance appraisal from economic growth to sustainable development. The government should give prominence to building a resource-conserving, environment-friendly society in the strategy for industrialization and get every community to act accordingly. The weights of the appraisal indicators related to energy consumption, resources use, ecological and environmental conservation should be improved, which can help the local governments to improve the sustainability of the development pathways.

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Table1 Four groups of 498 counties in Central China[a], 2006

Group	*Total*		*Province*					
	Amount	Percentage	Anhui	Henan	Hubei	Hunan	Jiangxi	Shanxi
ecological high-poverty communities	49	9.84%	9	14	7	4	5	10
non-ecological high-poverty communities	101	20.28%	9	17	18	16	16	25
sustainable communities	91	18.27%	17	16	6	18	22	12
non-ecological low-poverty communities	257	51.61%	26	62	33	50	37	49
Amount	498	100.00%	61	109	64	88	80	96

[a] Data comes from 2007 yearbooks of Anhui, Hunan, Henan, Jiangxi and Shanxi province.

Table 2 Variable means comparison between groups (2006)

Variable	Ecological high-poverty communities *(N=49)*		Non-ecological high-poverty communities *(N=101)*		Sustainable communities *(N=91)*		Non-ecological low-poverty communities *(N=257)*	
	Mean	SD[a]	Mean	SD	Mean	SD	Mean	SD
GDP	328420.7	216381.6	292880.6	205739.4	510757.7	414689.1	594878.3	415813.6
per capita GDP	6275.522	3109.559	5719.525	2620.621	10354.55	5481.572	10671.51	6457.93
growth rate of per capita GDP	15.29692	18.95243	14.78699	7.276543	17.19182	15.21084	16.57311	8.42922
proportion of secondary industry	39.25059	14.46132	36.11781	14.01369	42.65119	13.78044	46.09072	16.02947
total industrial output value	210131.1	182488	158485.6	161534	398467.8	504239.5	576255.7	680886.2
growth rate of total industrial output value	41.94588	44.72203	48.63966	104.8558	38.33541	24.70736	41.75661	49.02917
average output value per industrial enterprise	5834.418	4705.724	4286.861	3112.588	5715.946	4040.716	8415.424	10206.98
agricultural productivity per farmer	3401.574	1030.98	3220.904	1193.812	5009.788	1879.324	4469.881	2146.07
intensity of infrastructure construction	59.39514	47.09774	50.29473	43.65657	116.4211	119.3275	168.2857	288.538
fiscal revenue of local government	12269.27	10889.07	10204.99	6454.059	19373.31	17673.44	21313.8	18573.67
fiscal expenditure of local government	46334.12	18841.2	43444.01	18293.43	47664.09	22118.74	50714.42	22313.76
urbanization rate	14.85214	7.111021	16.75476	9.121	18.04186	8.967541	20.07275	11.07546
proportion of employed persons of total population	10.44261	8.05171	12.14955	11.38018	11.67272	8.942864	11.94202	8.437468
growth rate of employed persons	4.9999	14.15536	8.027828	50.04796	3.412366	10.33421	2.387167	12.66164
per capita urban & rural savings deposits	4458.421	1639.248	4375.739	2324.048	6148.42	3260.225	5986.918	3163.897
growth rate of per capita urban & rural savings deposits	22.24717	20.2096	27.51475	105.4888	13.7659	17.04729	16.24874	14.62676
average number of telephones for every 100 people	13.91238	5.381022	12.98788	6.994928	18.24084	6.052225	17.16265	6.528352
average number of hospital beds for every 10,000 people	16.63004	6.51275	16.7754	6.573288	18.00455	6.295481	18.81809	9.515515
average number of welfare home beds for every 10,000 people	17.77077	20.04329	15.00497	16.08767	17.46302	16.71058	14.31725	15.25688
area of cultivated land for every 10,000 people	868.5037	793.509	880.0001	588.8315	737.7303	280.3792	803.1385	356.9574
alterative rate of area of cultivated land for every 10,000 people	0.412407	3.818629	1.066687	5.445999	2.097918	7.795885	1.031698	6.907888

average number of gas pollutants factories for 100 KM^2	0.033552	0.073653	0.040288	0.077774	0.12854	0.336653	0.183731	0.369118
average number of water pollutants factories for 100 KM^2	0.025415	0.057313	0.036251	0.058615	0.089381	0.222818	0.139143	0.267428

[a] SD is standard deviation.

Table 3 Independent Samples Test

Groups	*Variable*	*Hypothesis*	*Levene's Test for Equality of Variances*		*t-test for Equality of Means*				*95% Confidence Interval of the Difference*	
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Ecological high-poverty communities and non-ecological high-poverty communities	average output value per industrial enterprise	Equal variances not assumed	6.776904	0.010175	2.09084	69.04621	0.040225	1547.558	70.99528	3024.12
Sustainable communities and non-ecological low-poverty communities	proportion of the secondary industry	Equal variances not assumed	4.952386	0.026699	-1.95776	182.1927	0.049314	-3.43953	-6.90596	-0.026902
	total industrial output value	Equal variances not assumed	5.495107	0.019635	-2.62192	212.5768	0.009376	-177788	-311450	-44125.3
	average output value per industrial enterprise	Equal variances not assumed	6.321825	0.012379	-3.53001	342.1242	0.000472	-2699.48	-4203.63	-1195.33
	agricultural productivity per farmer	Equal variances assumed	0.050125	0.822978	2.127931	346	0.034049	539.9069	40.87154	1038.942
	intensity of infrastructure construction	Equal variances not assumed	4.170018	0.041903	-2.36625	338.4359	0.018532	-51.8647	-94.9783	-8.75108

Table 4 Model Fitting Information

Model	*Model Fitting Criteria*	*Likelihood Ratio Tests*		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1198.903			
Final	852.442	346.461	57	.000

Table 5 Determinants of Development Pathways (Multi-logit Regression) [a]

Explanatory Variables	*Ecological high-poverty Communities(N=49)*		*Non-ecological high-poverty Communities(N=101)*		*Sustainable Communities(N=91)*	
	Coefficient [b]	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Intercept	2.493324	2.200945	3.924389**	1.896016	-2.410005	1.521524
Landscape(Mountains, hills, Plain)	0.033580***	0.013736	0.032251***	0.010658	0.010686	0.007566
population	-0.003025	0.002197	-0.001695	0.001646	-0.001031	0.001158
population intensity	-0.000022*	0.000012	-0.000009	0.000010	0.000005	0.000006
GDP	0.000401	0.000385	-0.000395	0.000364	0.000255	0.000215
per capita GDP	0.042736*	0.023957	0.013428	0.021018	-0.015174	0.016975
Value-added of the secondary industry	0.000027	0.000019	0.000014	0.000016	-0.000015	0.000011
proportion of secondary industry	-0.102038***	0.033931	-0.064311**	0.028194	-0.010652	0.025359
total industrial output value	0.000005	0.000006	0.000002	0.000006	-0.000002	0.000003
average output value per industrial enterprise	0.000002	0.000143	0.000078	0.000123	0.000010	0.000109
agricultural productivity per farmer	-0.000844***	0.000343	-0.000669**	0.000289	0.000161	0.000178
intensity of infrastructure construction	0.005631	0.029442	0.027264*	0.016521	0.007063	0.015098
fiscal revenue of local government	-0.000568***	0.000131	-0.000563***	0.000116	-0.000151*	0.000089
fiscal expenditure of local government	0.000397***	0.000105	0.000406***	0.000094	0.000190***	0.000073
urbanization rate	0.037730	0.043875	0.047791	0.034822	-0.027212	0.025658
proportion of employed persons of total population	-0.058696	0.045409	-0.008311	0.024274	-0.025654	0.019715
per capita urban & rural savings deposits	-0.000288	0.000270	-0.000171	0.000226	0.000265*	0.000154
average number of telephones for every 100 people	-0.244072**	0.119803	-0.326587***	0.106202	0.061167	0.064994
average number of hospital beds for every 10,000 people	0.027879	0.037364	-0.011596	0.030847	-0.033504	0.025621
average number of welfare home beds for every 10,000 people	0.017138	0.020162	0.003875	0.020040	0.012738	0.017137

[a] The reference category is non-ecological low-poverty communities (N=251).
[b] *,**,*** mean statistically significant at 10%, 5%, and 1% level, respectively.

Appendix 1 Independent Samples Test, ecological high-poverty communities and non-ecological high-poverty communities

Variable	*Hypothesis*	*Levene's Test for Equality of Variances*		*t-test for Equality of Means*			*Mean Difference*	*Std. Error Difference*	*95% Confidence Interval of the Difference*	
		F	Sig.	t	df	Sig. (2-tailed)			Lower	Upper
GDP	Equal variances assumed	0.27343	0.601822	0.975586	148	0.330862	35540.07	36429.47	-36449	107529.2
	Equal variances not assumed			0.958575	90.94204	0.340315	35540.07	37075.96	-38107.4	109187.5
per capita GDP	Equal variances assumed	0.468596	0.494704	1.145244	148	0.253957	555.9963	485.4828	-403.377	1515.37
	Equal variances not assumed			1.07939	82.09953	0.283575	555.9963	515.1023	-468.688	1580.68
growth rate of per capita GDP	Equal variances assumed	3.723193	0.055575	0.237363	148	0.812704	0.509927	2.148304	-3.73539	4.75524
	Equal variances not assumed			0.181946	54.97594	0.856294	0.509927	2.80263	-5.10672	6.126579
proportion of the secondary industry	Equal variances assumed	0.022668	0.880527	1.270768	148	0.205805	3.132777	2.465262	-1.73888	8.004436
	Equal variances not assumed			1.256903	92.48436	0.211954	3.132777	2.492458	-1.81711	8.082668
total industrial output value	Equal variances assumed	1.1501	0.285274	1.759333	148	0.080587	51645.5	29355.15	-6363.87	109654.9
	Equal variances not assumed			1.686304	85.49848	0.095383	51645.5	30626.44	-9242.94	112533.9
growth rate of total industrial output value	Equal variances assumed	0.688432	0.408035	-0.4278	148	0.669416	-6.69378	15.64685	-37.6139	24.2263
	Equal variances not assumed			-0.54714	146.2221	0.58512	-6.69378	12.23423	-30.8725	17.48499
average output value per industrial enterprise	Equal variances assumed	6.776904	0.010175	2.399156	148	0.017677	1547.558	645.0426	272.8745	2822.241
	Equal variances not assumed			2.09084	69.04621	0.040225	1547.558	740.1606	70.99528	3024.12
agricultural productivity per farmer	Equal variances assumed	1.497283	0.223034	0.907494	148	0.365621	180.6691	199.0858	-212.749	574.0869
	Equal variances not assumed			0.954826	108.684	0.341785	180.6691	189.2168	-194.365	555.7029
intensity of infrastructure construction	Equal variances assumed	1.48007	0.2257	1.166757	148	0.245185	9.100409	7.799745	-6.31284	24.51366
	Equal variances not assumed			1.136313	88.93954	0.258878	9.100409	8.008719	-6.81289	25.01371
fiscal revenue of local government	Equal variances assumed	5.176297	0.024333	1.452919	148	0.148363	2064.279	1420.78	-743.357	4871.915
	Equal variances not assumed			1.226598	64.85185	0.224409	2064.279	1682.931	-1296.91	5425.47

fiscal expenditure of local government	Equal variances assumed	0.007011	0.933384	0.898656	148	0.370295	2890.113	3216.038	-3465.17	9245.397
	Equal variances not assumed			0.889452	92.64404	0.376064	2890.113	3249.319	-3562.72	9342.943
urbanization rate	Equal variances assumed	7.527935	0.006826	-1.28252	148	0.201667	-1.90262	1.483504	-4.8342	1.028968
	Equal variances not assumed			-1.3967	118.8578	0.165107	-1.90262	1.362227	-4.6	0.79476
proportion of employed persons of total	Equal variances assumed	3.551837	0.06144	-0.94114	148	0.348169	-1.70694	1.813698	-5.29103	1.877152
population	Equal variances not assumed			-1.05752	128.2865	0.292264	-1.70694	1.614101	-4.90064	1.48677
growth rate of employed persons	Equal variances assumed	1.202869	0.27453	-0.41488	148	0.678832	-3.02793	7.298346	-17.4504	11.3945
	Equal variances not assumed			-0.56335	128.4226	0.57418	-3.02793	5.374873	-13.6627	7.606843
per capita urban & rural savings deposits	Equal variances assumed	1.712053	0.192748	0.223363	148	0.823561	82.68232	370.1709	-648.821	814.1854
	Equal variances not assumed			0.251226	128.5731	0.80204	82.68232	329.115	-568.5	733.8648
growth rate of per capita urban & rural	Equal variances assumed	0.818947	0.366959	-0.3459	148	0.729906	-5.26758	15.22842	-35.3608	24.82564
savings deposits	Equal variances not assumed			-0.48387	114.3396	0.629403	-5.26758	10.88634	-26.8327	16.29749
average number of telephones for every	Equal variances assumed	0.290476	0.590726	0.815032	148	0.416363	0.924498	1.134309	-1.31703	3.166032
100 people	Equal variances not assumed			0.891511	120.1886	0.374436	0.924498	1.037002	-1.12866	2.977656
average number of hospital beds for	Equal variances assumed	0.006112	0.937793	-0.1274	148	0.898797	-0.14536	1.140971	-2.40006	2.109339
every 10,000 people	Equal variances not assumed			-0.12781	95.92219	0.898566	-0.14536	1.137292	-2.40289	2.112172
average number of welfare home beds for	Equal variances assumed	1.563761	0.213089	0.909421	148	0.364606	2.765795	3.041269	-3.24412	8.775714
every 10,000 people	Equal variances not assumed			0.843123	78.99023	0.401706	2.765795	3.280419	-3.76373	9.295318
area of cultivated land for every 10,000	Equal variances assumed	0.999633	0.319031	-0.09972	148	0.920699	-11.4964	115.2827	-239.309	216.3164
people	Equal variances not assumed			-0.09009	74.51917	0.928454	-11.4964	127.605	-265.725	242.7326
alterative rate of area of cultivated land	Equal variances assumed	2.399464	0.123513	-0.75513	148	0.451371	-0.65428	0.866447	-2.36648	1.057925
for every 10,000 people	Equal variances not assumed			-0.8509	129.1197	0.396398	-0.65428	0.768923	-2.1756	0.86704
average number of gas pollutants	Equal variances assumed	0.31401	0.576077	-0.50602	148	0.613596	-0.00674	0.013312	-0.03304	0.019569
factories for 100 KM^2	Equal variances not assumed			-0.51572	99.94064	0.607191	-0.00674	0.013061	-0.03265	0.019177
average number of water pollutants	Equal variances assumed	0.732082	0.393592	-1.06954	148	0.286568	-0.01084	0.010132	-0.03086	0.009185
factories for 100 KM^2	Equal variances not assumed			-1.07796	97.07629	0.283724	-0.01084	0.010053	-0.03079	0.009115

Appendix 2 Independent Samples Test, sustainable communities and non-ecological low-poverty communities

Variable	*Hypothesis*	*Levene's Test for Equality of Variances*		*t-test for Equality of Means*			*Mean Difference*	*Std. Error Difference*	*95% Confidence Interval of the Difference*	
		F	Sig.	t	df	Sig. (2-tailed)			Lower	Upper
GDP	Equal variances assumed	0.314614	0.575225	-1.65961	346	0.097899	-84120.5	50686.9	-183814	15572.69
	Equal variances not assumed			-1.66176	158.4291	0.098538	-84120.5	50621.29	-184100	15859.07
per capita GDP	Equal variances assumed	0.48042	0.488697	-0.41784	346	0.676325	-316.966	758.5849	-1808.98	1175.052
	Equal variances not assumed			-0.45167	184.5307	0.652036	-316.966	701.7617	-1701.47	1067.542
growth rate of per capita GDP	Equal variances assumed	1.015657	0.314256	0.477662	346	0.633193	0.618709	1.295288	-1.92892	3.166339
	Equal variances not assumed			0.368502	110.1788	0.713206	0.618709	1.678985	-2.70858	3.946004
proportion of the secondary industry	Equal variances assumed	4.952386	0.026699	-1.82196	346	0.069324	-3.43953	1.887815	-7.15257	0.273508
	Equal variances not assumed			-1.95776	182.1927	0.049314	-3.43953	1.756872	-6.90596	-0.026902
total industrial output value	Equal variances assumed	5.495107	0.019635	-2.27855	346	0.023303	-177788	78026.89	-331255	-24321.2
	Equal variances not assumed			-2.62192	212.5768	0.009376	-177788	67808.21	-311450	-44125.3
growth rate of total industrial output value	Equal variances assumed	0.742119	0.389579	-0.63719	346	0.524422	-3.42119	5.369184	-13.9815	7.139152
	Equal variances not assumed			-0.85365	306.4778	0.393965	-3.42119	4.00772	-11.3073	4.464936
average output value per industrial enterprise	Equal variances assumed	6.321825	0.012379	-2.45387	346	0.014625	-2699.48	1100.088	-4863.18	-535.777
	Equal variances not assumed			-3.53001	342.1242	0.000472	-2699.48	764.7226	-4203.63	-1195.33
agricultural productivity per farmer	Equal variances assumed	0.050125	0.822978	2.127931	346	0.034049	539.9069	253.7239	40.87154	1038.942
	Equal variances not assumed			2.26675	178.8918	0.024603	539.9069	238.1855	69.8923	1009.922
intensity of infrastructure construction	Equal variances assumed	4.170018	0.041903	-1.66382	346	0.097055	-51.8647	31.17213	-113.175	9.446049
	Equal variances not assumed			-2.36625	338.4359	0.018532	-51.8647	21.91847	-94.9783	-8.75108
fiscal revenue of local government	Equal variances assumed	0.238062	0.625919	-0.8672	346	0.386433	-1940.48	2237.642	-6341.58	2460.608
	Equal variances not assumed			-0.88804	165.272	0.375808	-1940.48	2185.123	-6254.84	2373.869
fiscal expenditure of local government	Equal variances assumed	0.082195	0.774516	-1.1232	346	0.262132	-3050.33	2715.75	-8391.78	2291.129

	Equal variances not assumed			-1.12793	159.2798	0.261047	-3050.33	2704.37	-8391.38	2290.72
urbanization rate	Equal variances assumed	2.632304	0.10562	-1.57545	346	0.116068	-2.03089	1.289088	-4.56632	0.504548
	Equal variances not assumed			-1.74083	193.6182	0.083302	-2.03089	1.166619	-4.3318	0.270026
proportion of employed persons of total	Equal variances assumed	0.026841	0.869959	-0.25755	346	0.796907	-0.2693	1.045621	-2.32587	1.787273
population	Equal variances not assumed			-0.25049	150.4226	0.802552	-0.2693	1.075105	-2.39356	1.854957
growth rate of employed persons	Equal variances assumed	0.004201	0.948361	0.694611	346	0.487765	1.025199	1.475932	-1.87773	3.928126
	Equal variances not assumed			0.764694	192.0306	0.445393	1.025199	1.340666	-1.61912	3.66952
per capita urban & rural savings deposits	Equal variances assumed	0.067591	0.795032	0.415135	346	0.6783	161.5022	389.035	-603.669	926.6734
	Equal variances not assumed			0.409223	154.0119	0.682945	161.5022	394.656	-618.135	941.1398
growth rate of per capita urban & rural	Equal variances assumed	0.002213	0.96251	-1.3309	346	0.1841	-2.48283	1.865534	-6.15204	1.186382
savings deposits	Equal variances not assumed			-1.2374	139.6992	0.218013	-2.48283	2.006483	-6.44983	1.484169
average number of telephones for every	Equal variances assumed	1.489901	0.223063	1.37936	346	0.168675	1.078192	0.781662	-0.45921	2.615599
100 people	Equal variances not assumed			1.430165	169.3298	0.154512	1.078192	0.753894	-0.41005	2.566433
average number of hospital beds for	Equal variances assumed	3.743513	0.053828	-0.75854	346	0.448645	-0.81353	1.072501	-2.92298	1.295908
every 10,000 people	Equal variances not assumed			-0.91655	239.4225	0.360301	-0.81353	0.887606	-2.56205	0.934979
average number of welfare home beds for	Equal variances assumed	1.861186	0.173375	1.64803	346	0.100254	3.145767	1.908805	-0.60855	6.900088
every 10,000 people	Equal variances not assumed			1.577953	146.483	0.116733	3.145767	1.993574	-0.79412	7.08565
area of cultivated land for every 10,000	Equal variances assumed	3.320049	0.069303	-1.58308	346	0.114316	-65.4082	41.31695	-146.672	15.85581
people	Equal variances not assumed			-1.77385	199.8116	0.077612	-65.4082	36.87365	-138.12	7.303236
alterative rate of area of cultivated land	Equal variances assumed	0.871248	0.351261	1.222557	346	0.222329	1.066219	0.872122	-0.64911	2.781548
for every 10,000 people	Equal variances not assumed			1.154075	143.1102	0.250393	1.066219	0.923874	-0.75998	2.892422
average number of gas pollutants	Equal variances assumed	1.562077	0.212206	-1.25348	346	0.210877	-0.05519	0.044031	-0.14179	0.03141
factories for 100 KM^2	Equal variances not assumed			-1.30979	171.9732	0.192015	-0.05519	0.042138	-0.13837	0.027982
average number of water pollutants	Equal variances assumed	2.478327	0.116339	-1.58993	346	0.112763	-0.04976	0.031298	-0.11132	0.011796
factories for 100 KM^2	Equal variances not assumed			-1.73366	188.0278	0.084618	-0.04976	0.028703	-0.10638	0.00686

Figure 1 The six provinces in Central China